

## 6. Law of Variable Proportions

*Law of Variable Proportions is also known as the Law of Diminishing Returns.* This law is a generalization which the economists make about the nature of technology which makes possible to combine the same factors of production in a number of different proportions to make the same product.

**The Law States :** When increasing amounts of one factor of production are employed in production along with a fixed amount of some other production factor, after some point, the resulting increases in output of product become smaller and smaller. (That is, first the marginal returns to successive small increases in the variable factor of production turn down and then eventually the overall average returns per unit of the variable input start decreasing.)

Before discussing this law if we discuss about total product, average product and marginal product.

### Total Product

**“ According to Samuelson** *"An increase in some inputs relative to other fixed inputs will in a given state of technology cause output to increase, but after a point the extra output resulting from the same additions of extra inputs will become less and less."*  
**According to Benham** *"As the proportion of the factor in a combination of factors is increased after a point, first the marginal and then the average product of that factor will diminish."*

Variable proportion production function, the technical Coefficient of production is variable, i.e. the required quantity of output can be achieved through the combination of different quantities of factors of production, such as these factors can be varied by substituting other factor/ factors in its place.

The law of variable proportion of law of diminishing returns examine the production function with one factor variable keeping quantities other factor is fixed. This law operates in short run, when all factors of production cannot be increased or decreased simultaneously.

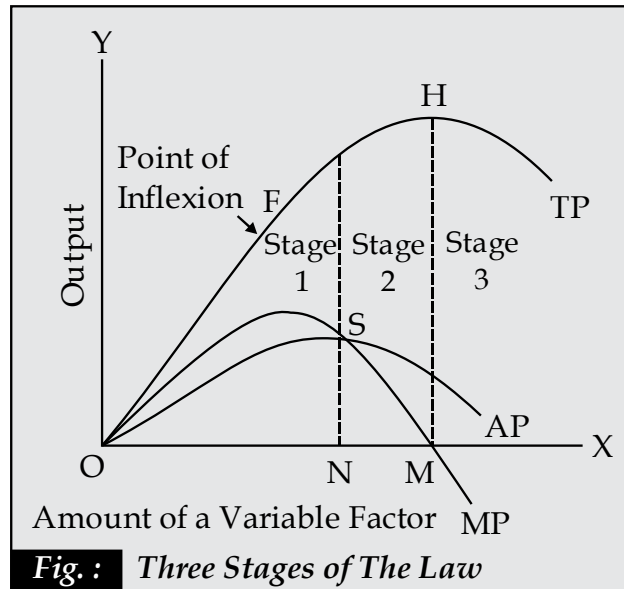
### Assumption

- Only one factor is variable while other factor is constant.
- All unit of variable factors are homogeneous.
- There is no change in technology.
- It is possible to vary the proportions in which different inputs are combined.
- It assumes a short term situation, in long run all factors are variable.
- The product is measured in physical unit than decreasing returns if the price of the products rises, even though the output might have decline.

### Three Stages of The Law

There are three phases or stages of production, as determined by the law of variable proportions:

- (i) Increasing returns
- (ii) Diminishing returns
- (iii) Negative returns



### (i) Stage of Increasing Returns

The first stage of the law of variable proportions is generally called the stage of increasing returns. In this stage as a variable resource (labor) is added to fixed inputs of other resources, the total product increases up to a point at an increasing rate.

The total product from the origin to the point K on the slope of the total product curve increases at an increasing rate. From point K onward, during the stage II, the total product no doubt goes on rising but its slope is declining. This means that from point K onward, the total product increases at a diminishing rate. In the first stage, marginal product curve of a variable factor rises in a part and then falls. The average product curve rises throughout and remains below the MP curve.

**Causes of Initial Increasing Returns :** The phase of increasing returns starts when the quantity of a fixed factor is abundant relative to the quantity of the variable factor. As more and more units of the variable factor are added to the constant quantity of the fixed factor, it is more intensively and effectively used. This causes the production to increase at a rapid rate. Another reason of increasing returns is that the fixed factor initially taken is indivisible. As more units of the variable factor are employed to work on it, output increases greatly due to fuller and effective utilization of the variable factor.

### (ii) Stage of Diminishing Returns

This is the most important stage in the production function. In stage 2, the total production continues to increase at a diminishing rate until it reaches its maximum point (H) where the 2<sup>nd</sup> stage ends. In this stage both the marginal product (MP) and average product of the variable factor are diminishing but are positive.

**Causes of Diminishing Returns :** The 2nd phase of the law occurs when the fixed factor becomes inadequate relative to the quantity of the variable factor. As more and more units of a variable factor are employed, the marginal and average product decline. Another reason of diminishing returns in the production function is that the fixed indivisible factor is being worked too hard. It is being used in non-optimal proportion with the variable factor, Mrs. J. Robinson still goes deeper and says that the diminishing returns occur because the factors of production are imperfect substitutes of one another.

### (iii) Stage of Negative Returns

In the 3<sup>rd</sup> stage, the total production declines. The TP, curve slopes downward (From point H onward). The MP curve falls to zero at point M and then is negative. It goes below the X axis with the increase in the use of variable factor (labor).

**Causes of Negative Returns :** The 3<sup>rd</sup> phases of the law starts when the number of a variable, factor becomes, too excessive relative, to the fixed factors, A producer cannot operate in this stage because total production declines with the employment of additional labor.

A rational producer will always seek to produce in stage 2 where MP and AP of the variable factor are diminishing. At which particular point, the producer will decide to produce depends upon the price of the factor he has to pay. The producer will employ the variable factor (say labor) up to the point where the marginal product of the labor equals the given wage rate in the labor market.

Total Product	Marginal Product	Average Product
<b>Stage I</b> First increases at increasing rate then at diminishing rate.	Increases in the beginning then reaches a maximum and begins to decrease.	First increases, continues to increase and becomes maximum.
<b>Stage II</b> Continues to increase at diminishing rate and becomes maximum.	Continues to diminish and becomes equal to zero.	Becomes equal to MP and then begins to diminish.
<b>Stage III</b> Diminishes	Becomes negative	Continues to diminish but will always be greater than zero.

### Cause of Diminishing Factor

**1. Under Utilization of Fixed Factor :** In initial stage of production, fixed factors of production like land or machine, is under-utilized. More units of variable factor, like labour, are needed for its proper utilization. As a result of employment of additional units of variable factors there is proper utilization of fixed factor. In short, increasing returns to a factor begins to manifest itself in the first stage.

**2. Fixed Factors of Production :** The foremost cause of the operation of this law is that some of the factors of production are fixed during the short period. When the fixed factor is used with variable factor, then its ratio compared to variable factor falls. Production is the result of the co-operation of all factors. When an additional unit of a variable factor has to produce with the help of relatively fixed factor, then the marginal return of variable factor begins to decline.

**3. Optimum Production :** After making the optimum use of a fixed factor, then the marginal return of such variable factor begins to diminish. The simple reason is that after the optimum use, the ratio of fixed and variable factors become defective. Let us suppose a machine is a fixed factor of production. It is put to optimum use when 4 labourers are employed on it. If 5 labourers are put on it, then total production increases very little and the marginal product diminishes.

**4. Imperfect Substitutes :** Mrs. Joan Robinson has put the argument that imperfect substitution of factors is mainly responsible for the operation of the law of diminishing returns. One factor cannot be used in place of the other factor. After optimum use of fixed factors, variable factors are increased and the amount of fixed factor could be increased by its substitutes.

The postponement of the law of variable proportions is possible under following conditions :

- (i) **Improvement in Technique of Production :** The operation of the law can be postponed in case variable factors techniques of production are improved.
- (ii) **Perfect Substitute :** The law of variable proportion can also be postponed in case factors of production are made perfect substitutes i.e., when one factor can be substituted for the other.



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